

Fig. 1

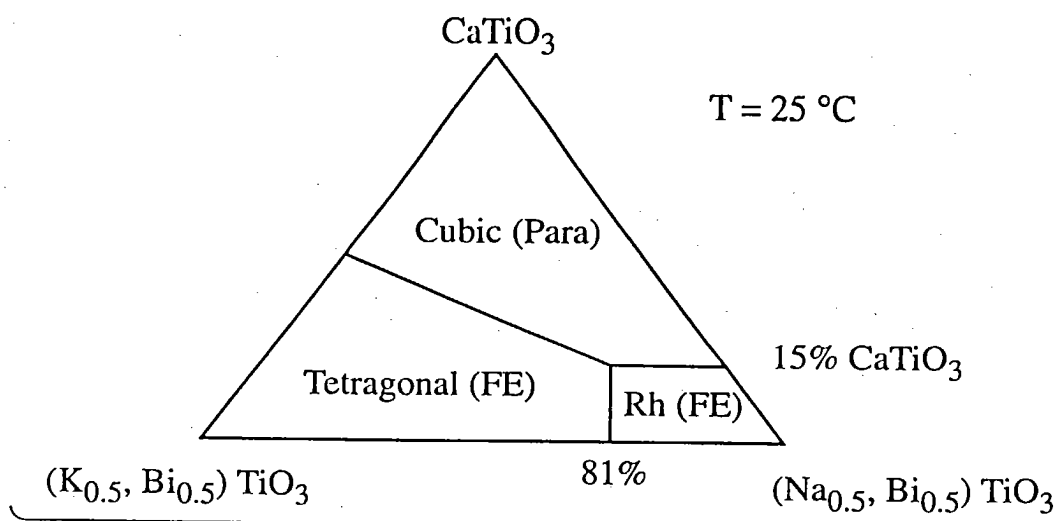


Fig. 2

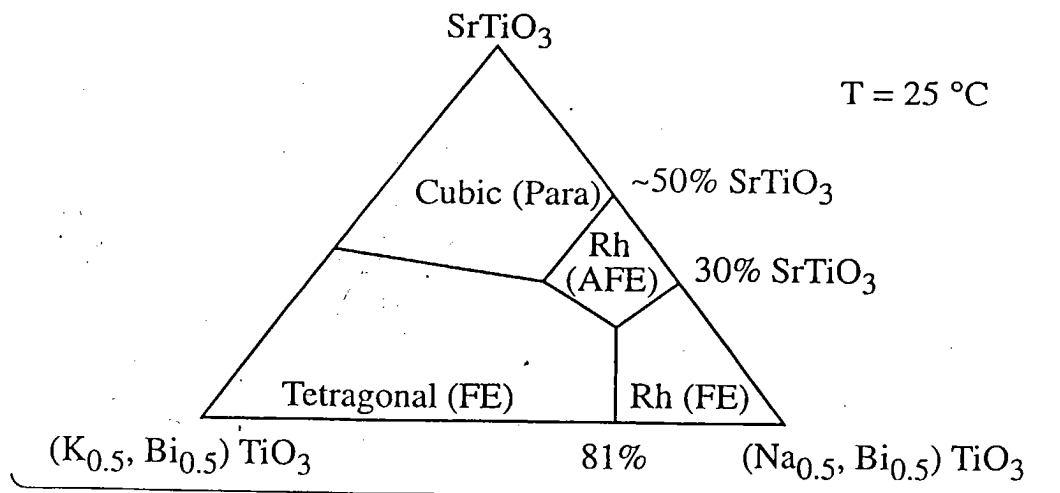


Fig. 3

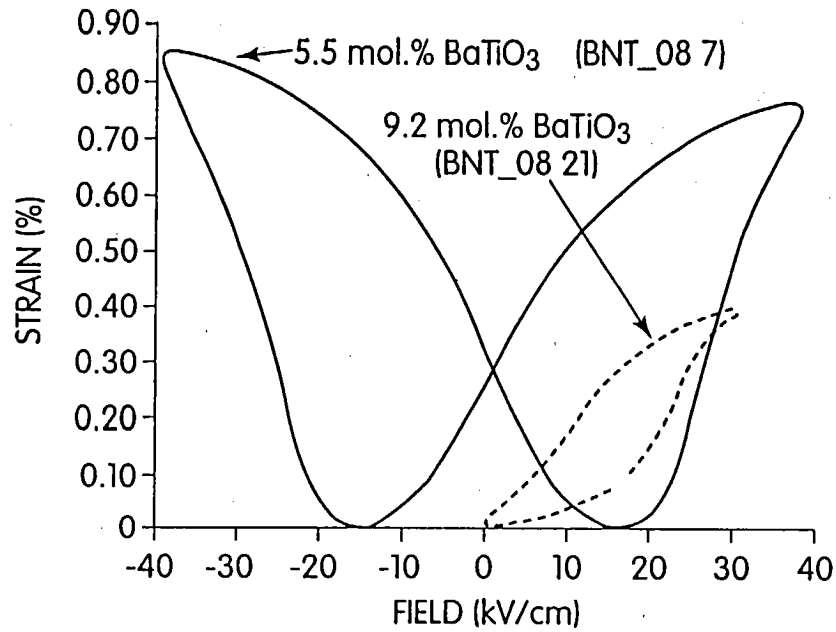


Fig. 4

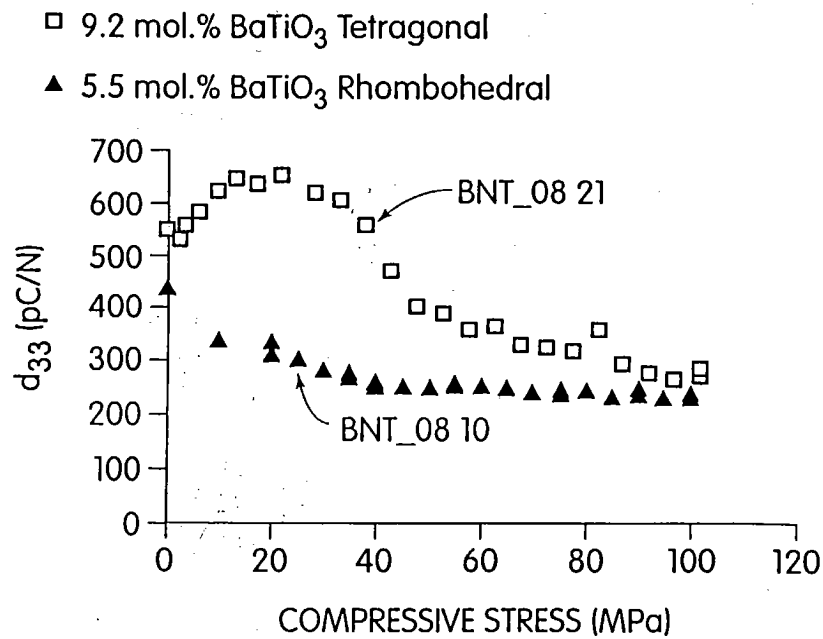


Fig. 5

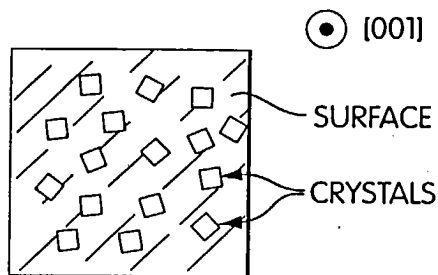


Fig. 6A

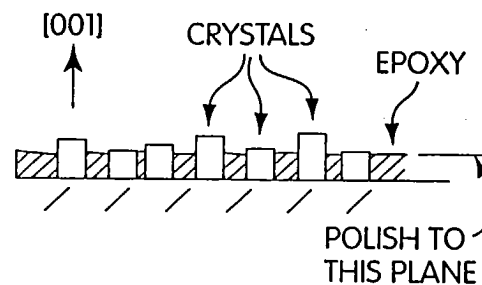


Fig. 6B

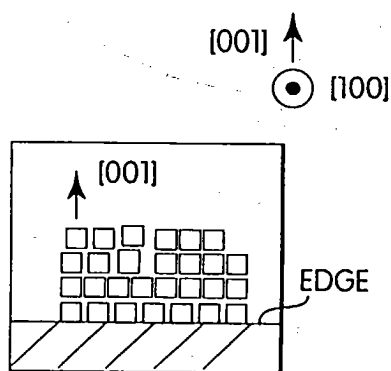


Fig. 7A

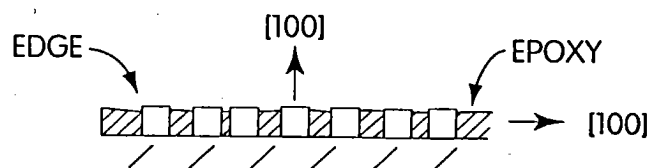


Fig. 7B

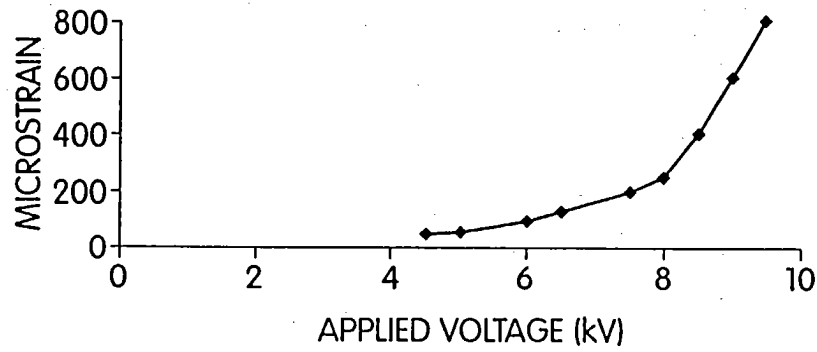


Fig. 8

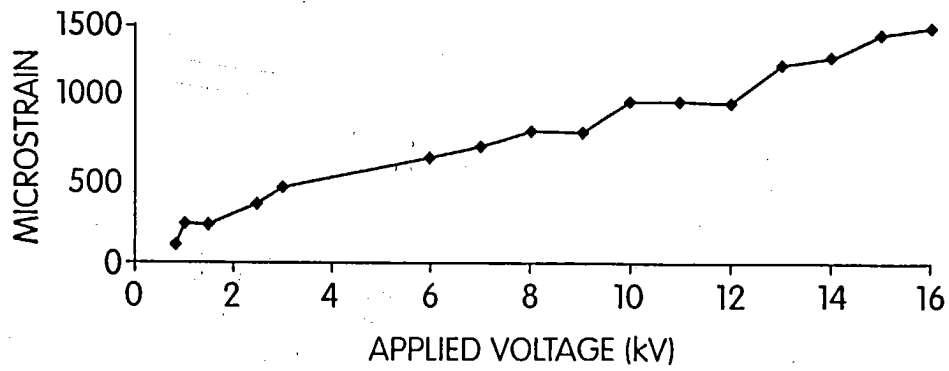


Fig. 9

M00925.70138.US
ELECTROMECHANICAL ACTUATORS
By: Yet-Ming Chiang, et al.
Express Mail Label No.: EV292560361US
Date of Deposit: August 5, 2003

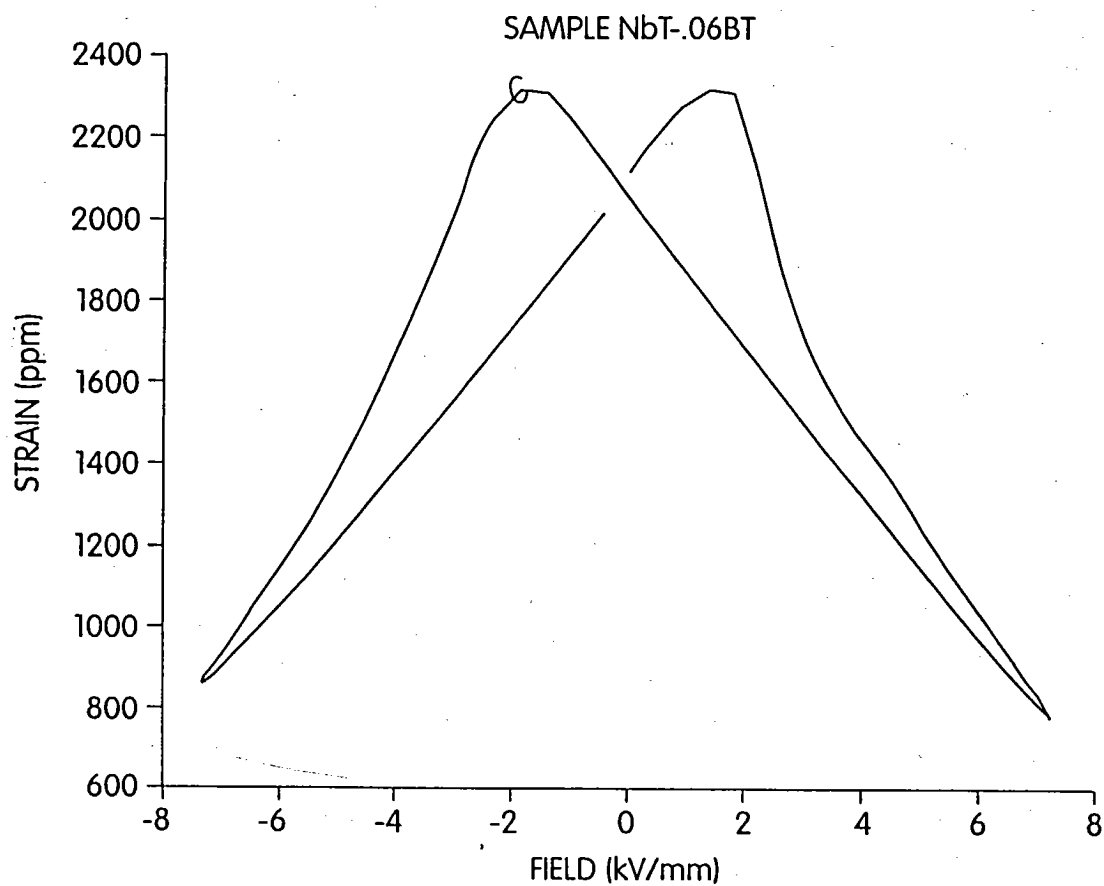


Fig. 10

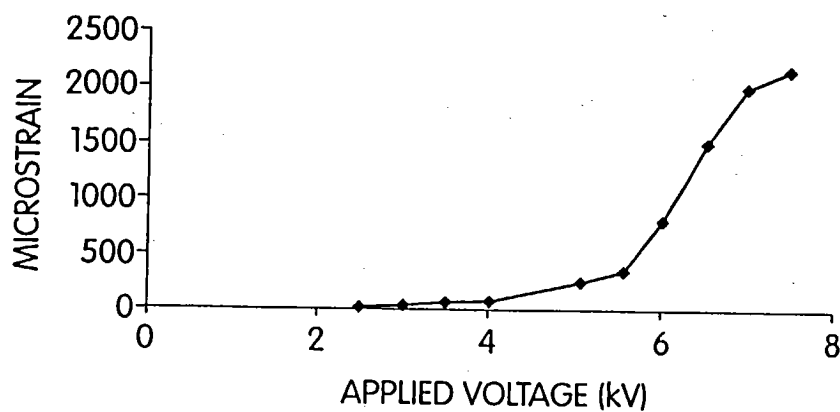


Fig. 11

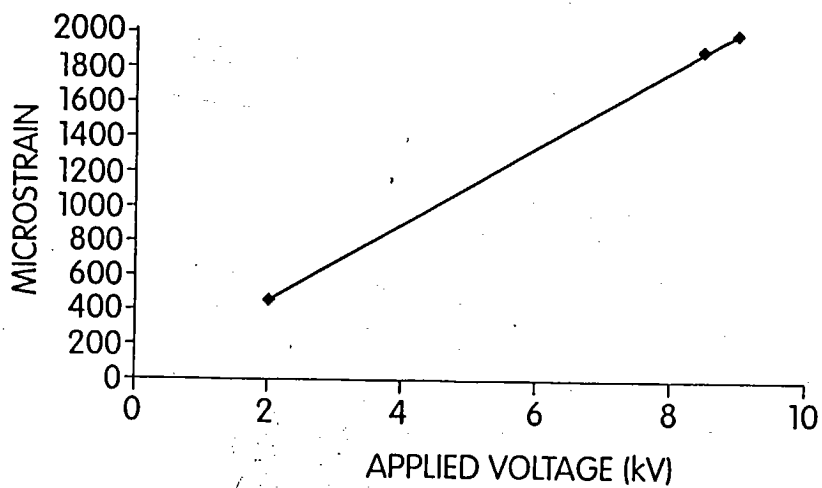


Fig. 12

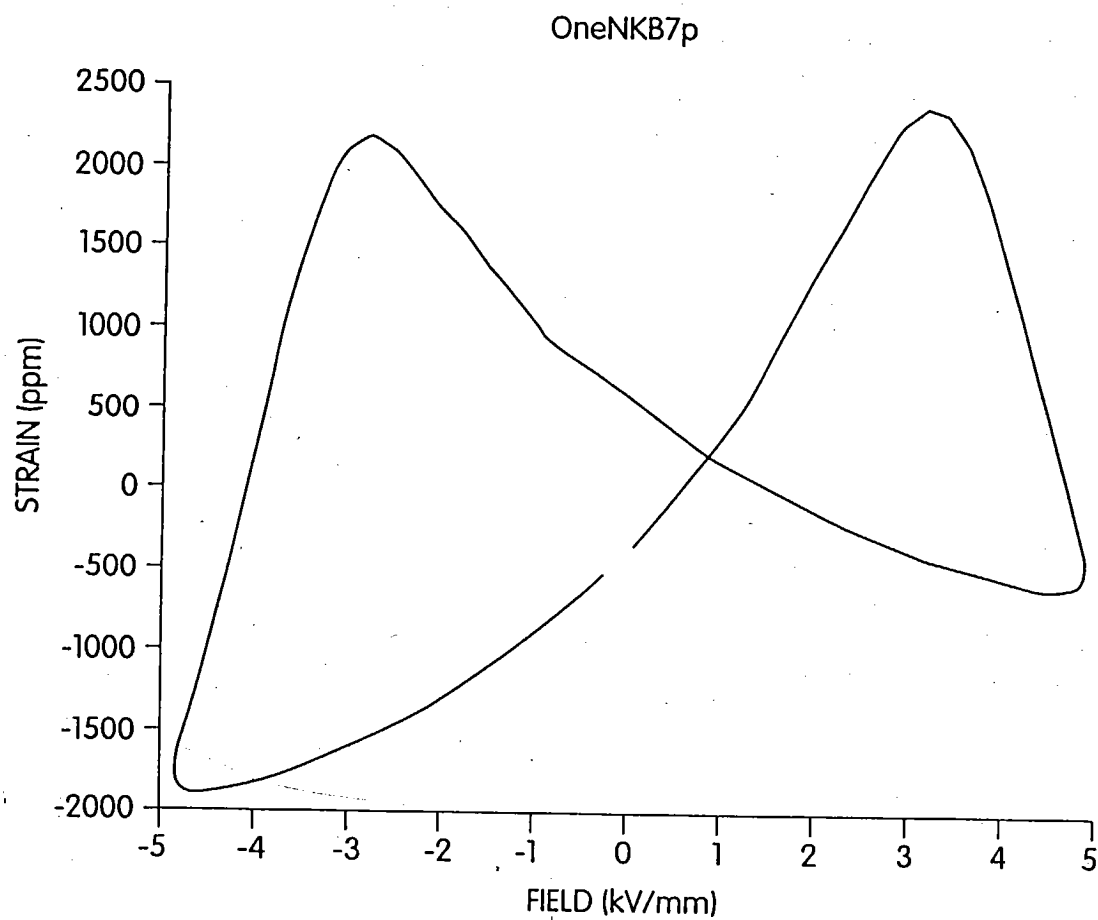


Fig. 13

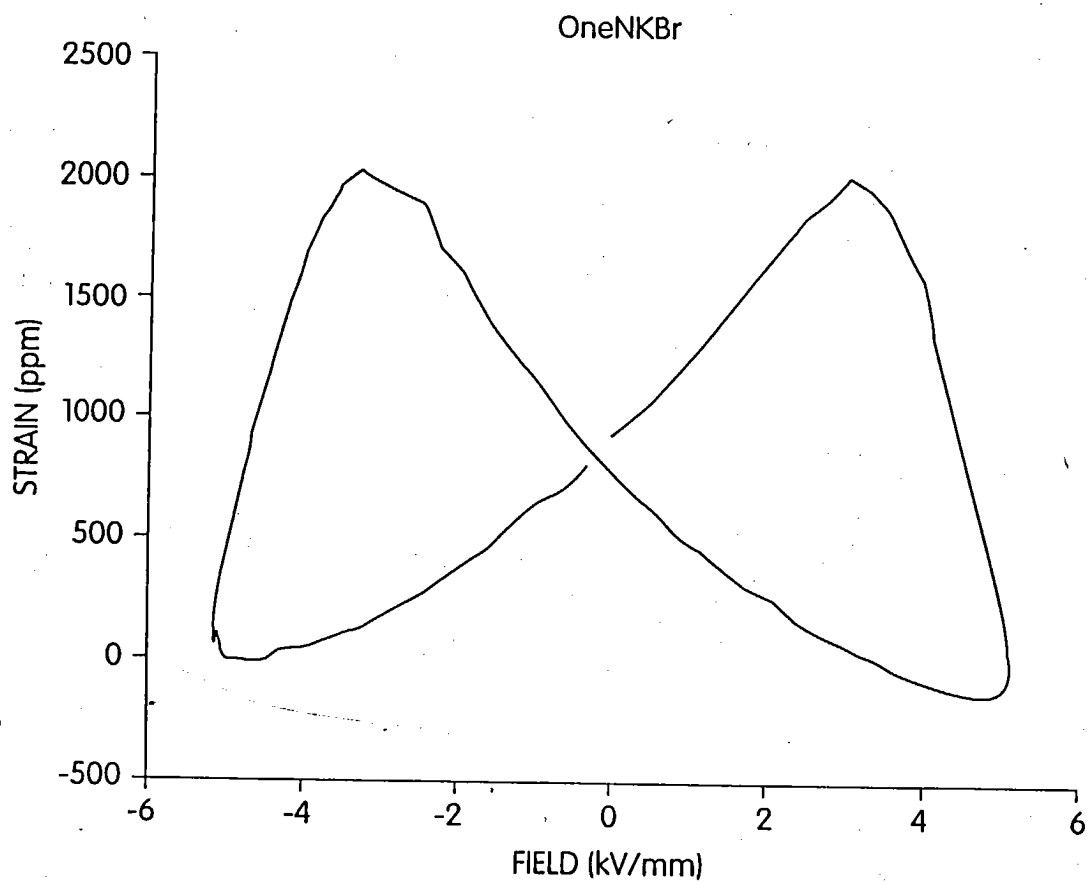


Fig. 14

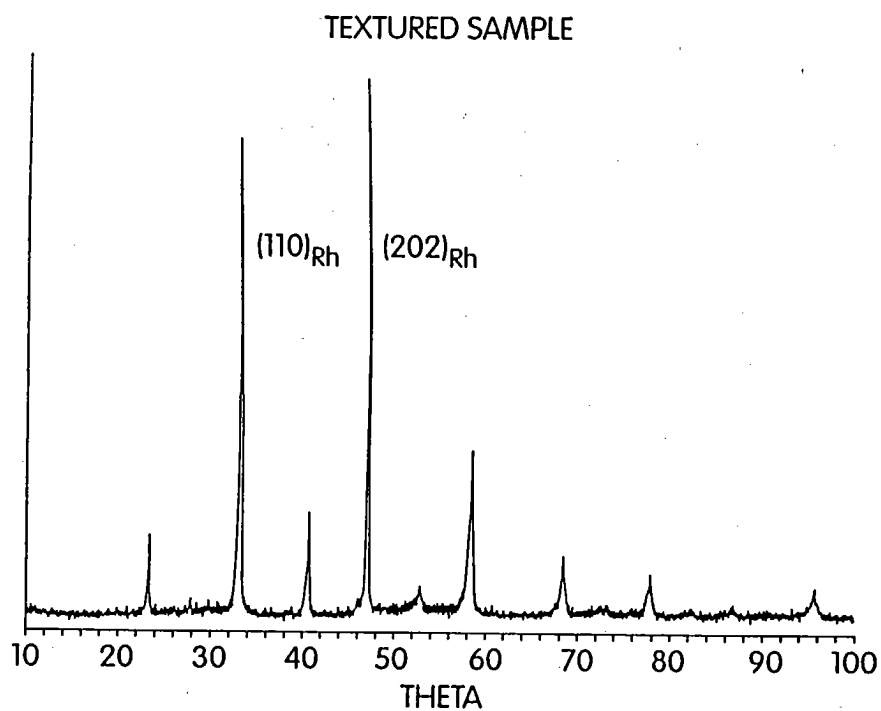


Fig. 15A

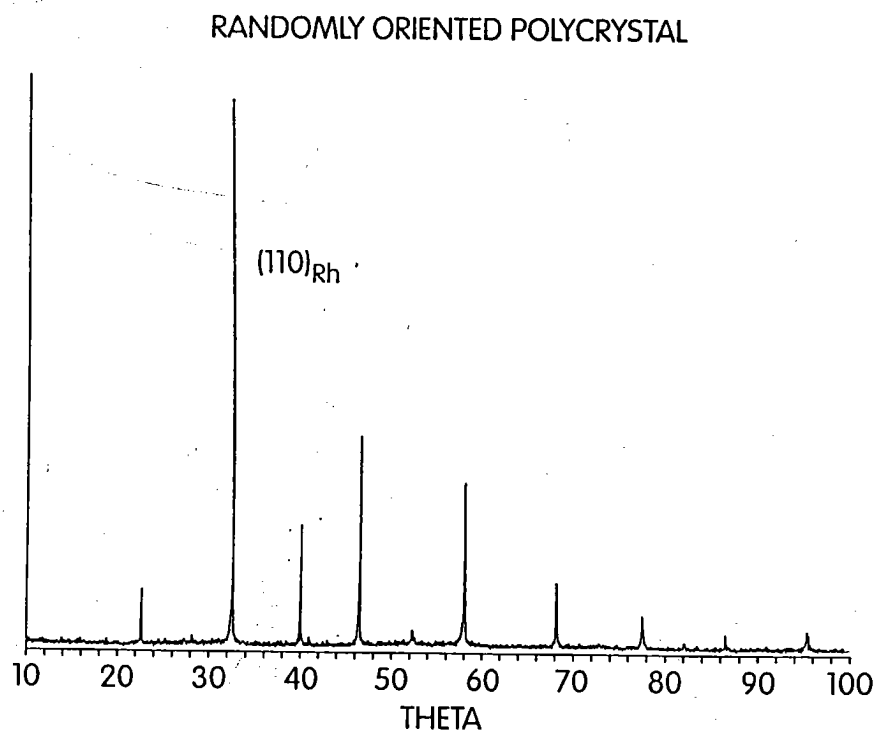


Fig. 15B

M00925.70138.US
ELECTROMECHANICAL ACTUATORS
By: Yet-Ming Chiang, et al.
Express Mail Label No.: EV292560361US
Date of Deposit: August 5, 2003

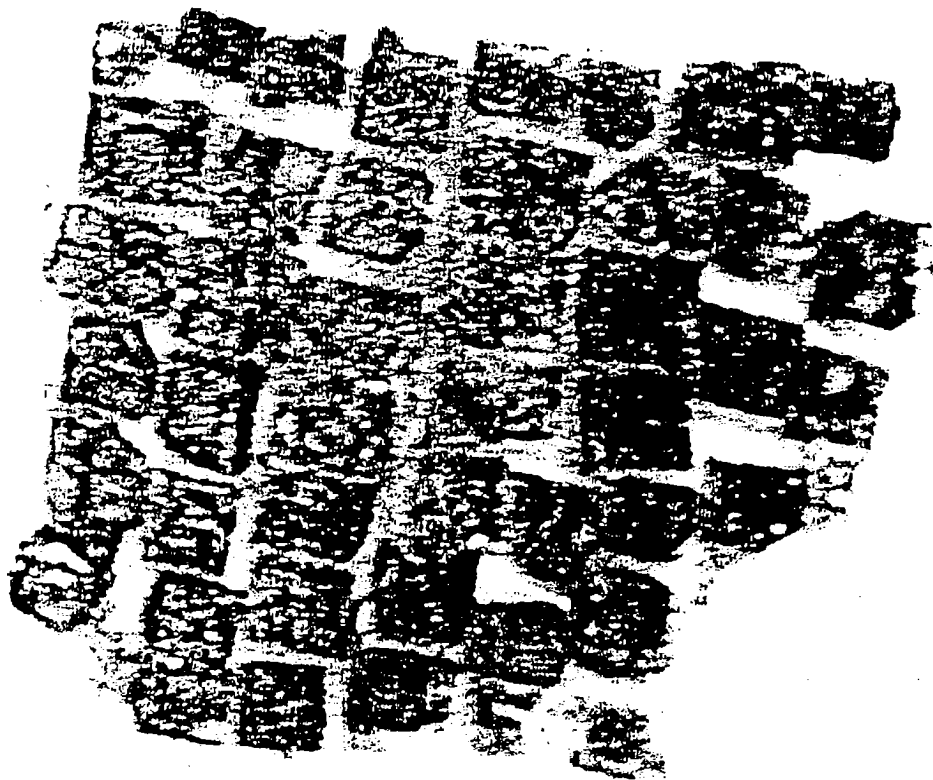


Fig. 16

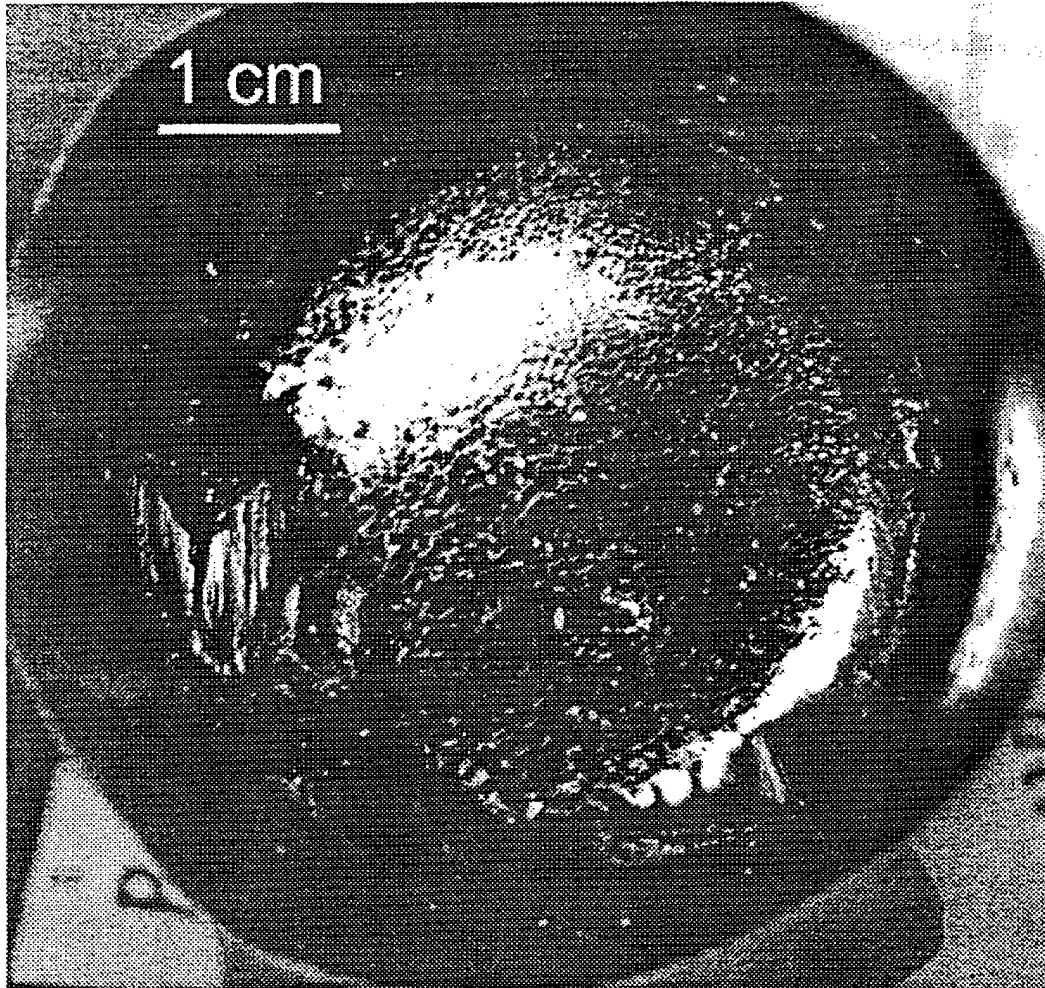


Fig. 17

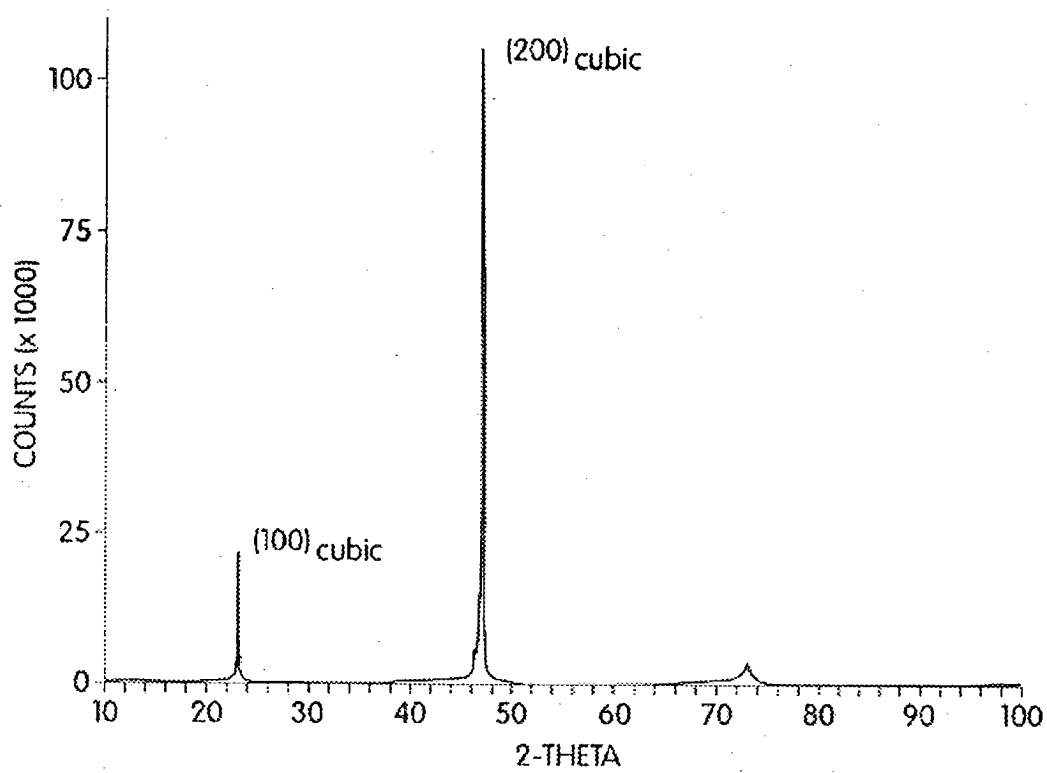


Fig. 18

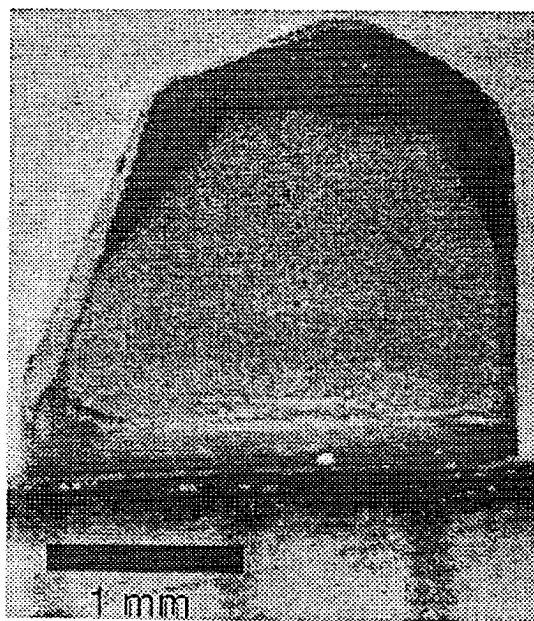


Fig. 19

M00925.70138.US
ELECTROMECHANICAL ACTUATORS
By: Yet-Ming Chiang, et al.
Express Mail Label No.: EV292560361US
Date of Deposit: August 5, 2003

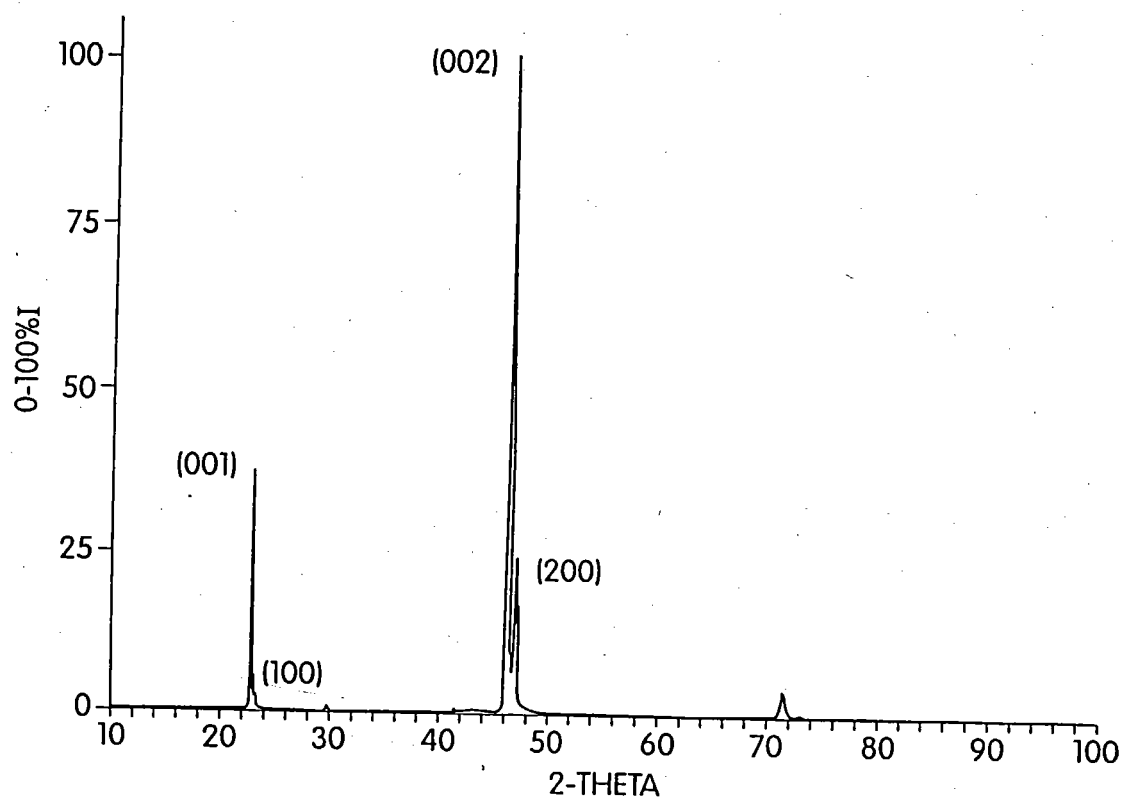


Fig. 20

M00925.70138.US
ELECTROMECHANICAL ACTUATORS
By: Yet-Ming Chiang, et al.
Express Mail Label No.: EV292560361US
Date of Deposit: August 5, 2003

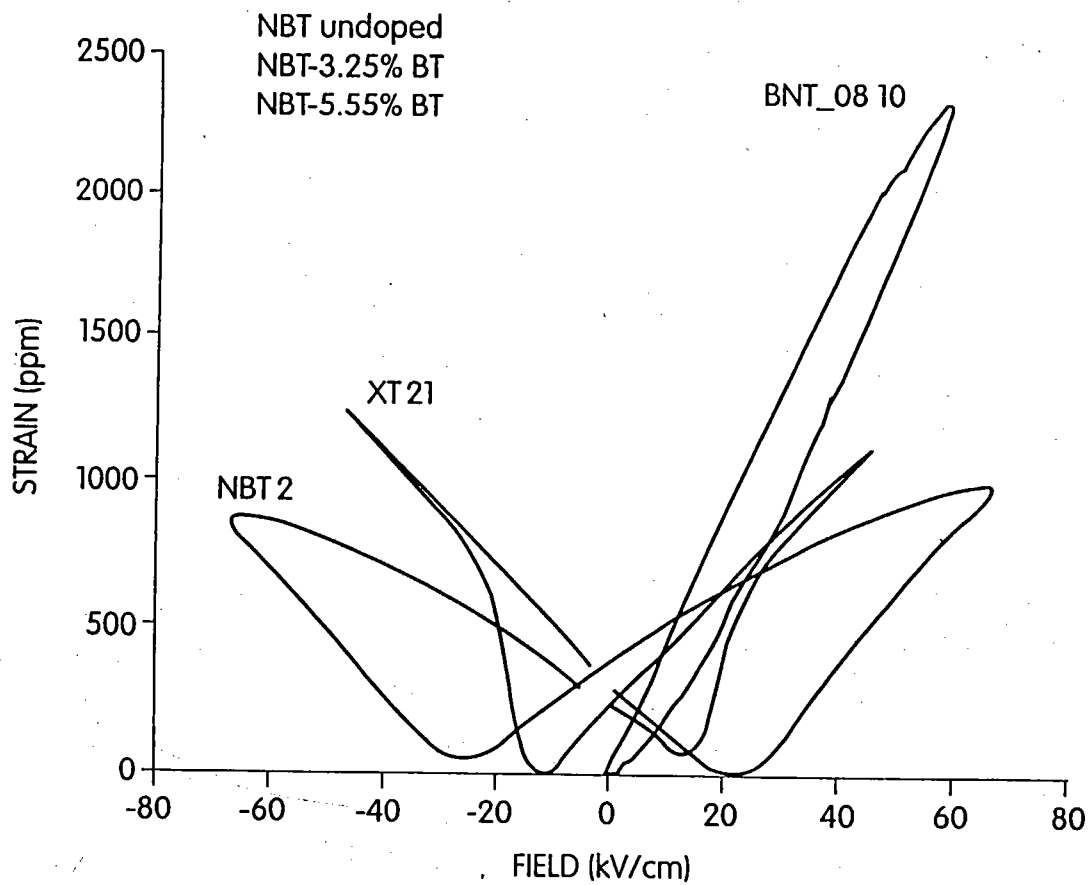


Fig. 21

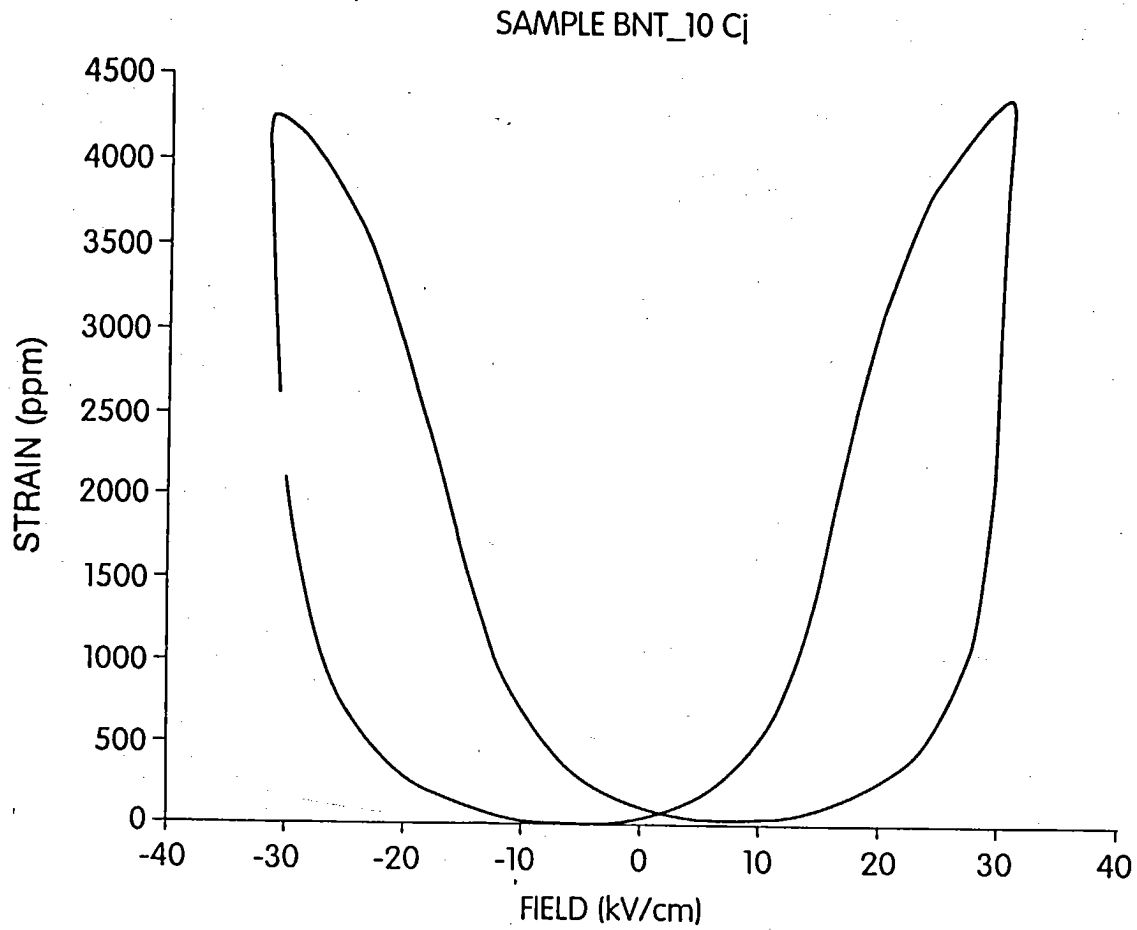


Fig. 22

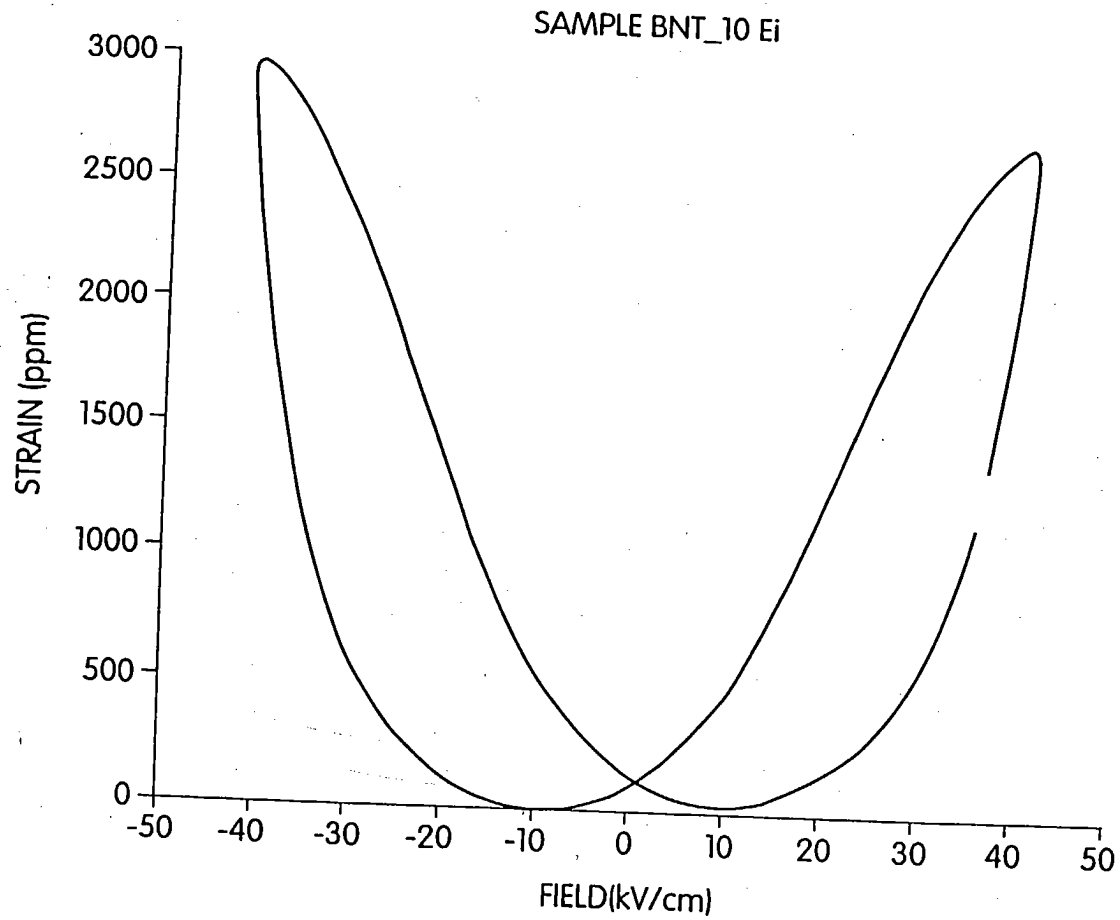


Fig. 23

M00925.70138.US

ELECTROMECHANICAL ACTUATORS

By: Yet-Ming Chiang, et al.

Express Mail Label No.: EV292560361US

Date of Deposit: August 5, 2003

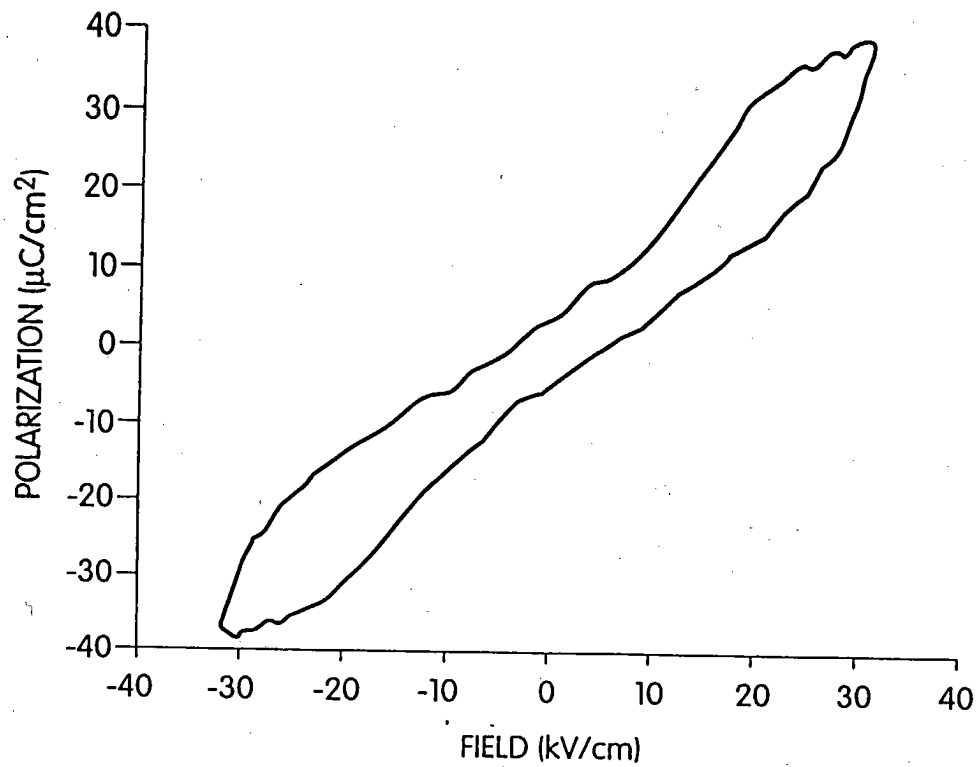


Fig. 24

M00925.70138.US
ELECTROMECHANICAL ACTUATORS
By: Yet-Ming Chiang, et al.
Express Mail Label No.: EV292560361US
Date of Deposit: August 5, 2003

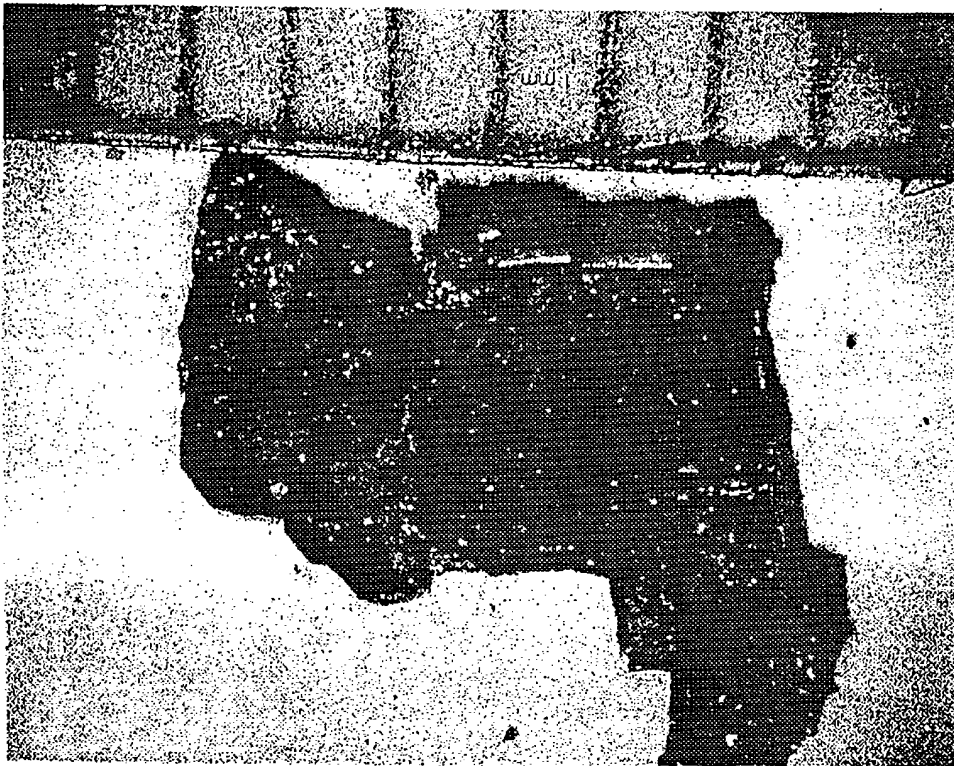


Fig. 25

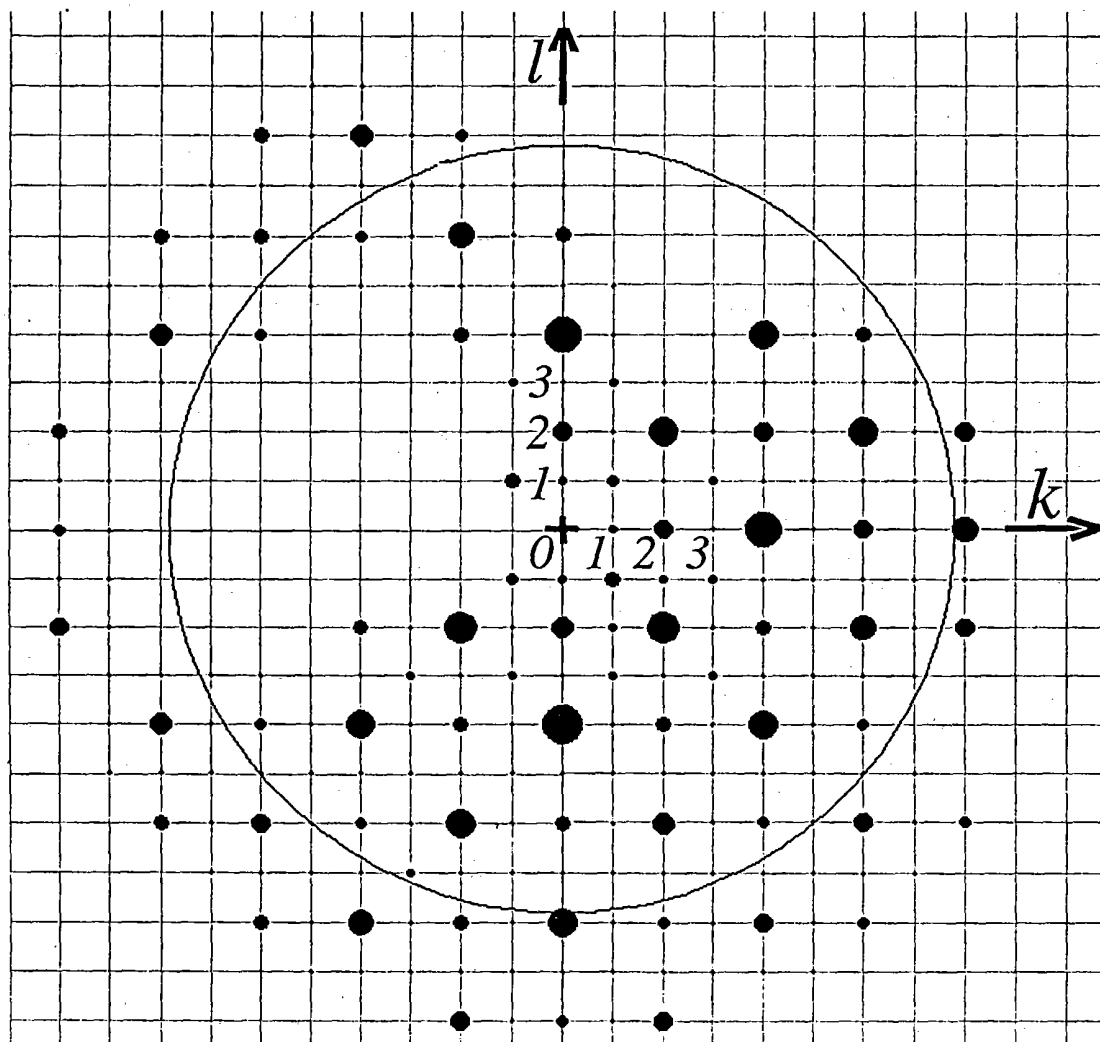


Fig. 26

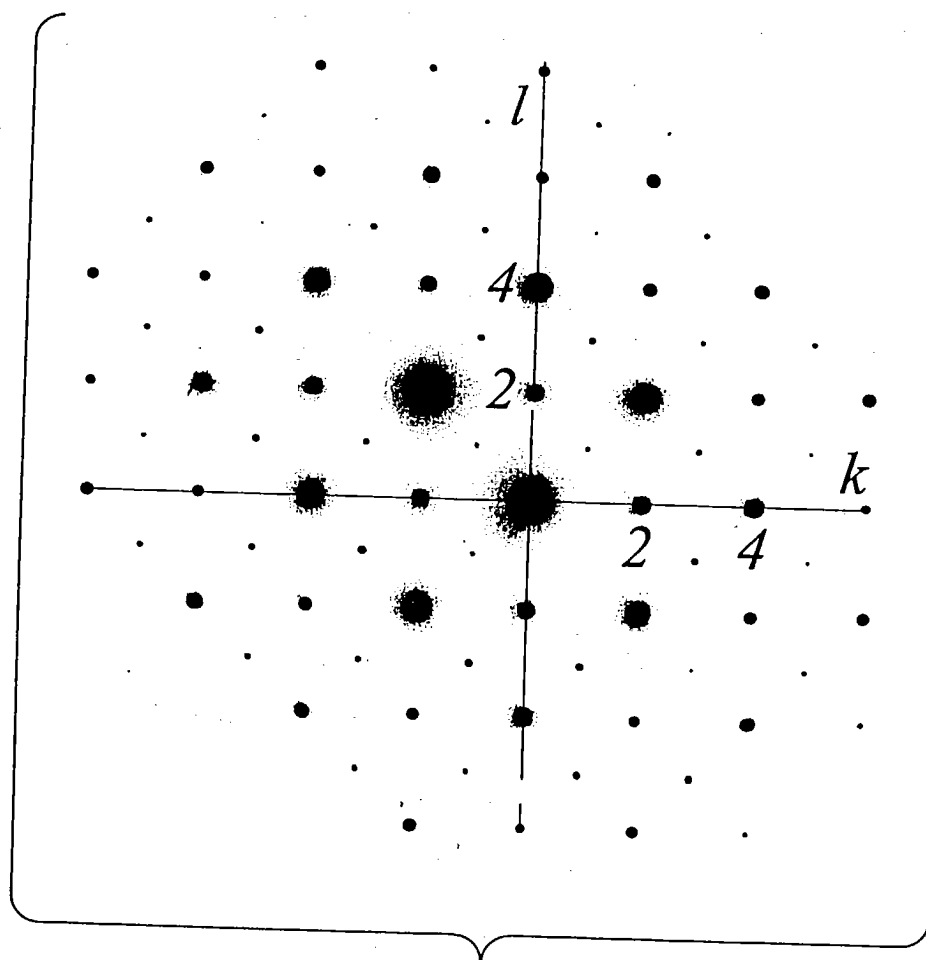


Fig. 27

M00925.70138.US
ELECTROMECHANICAL ACTUATORS
By: Yet-Ming Chiang, et al.
Express Mail Label No.: EV292560361US
Date of Deposit: August 5, 2003

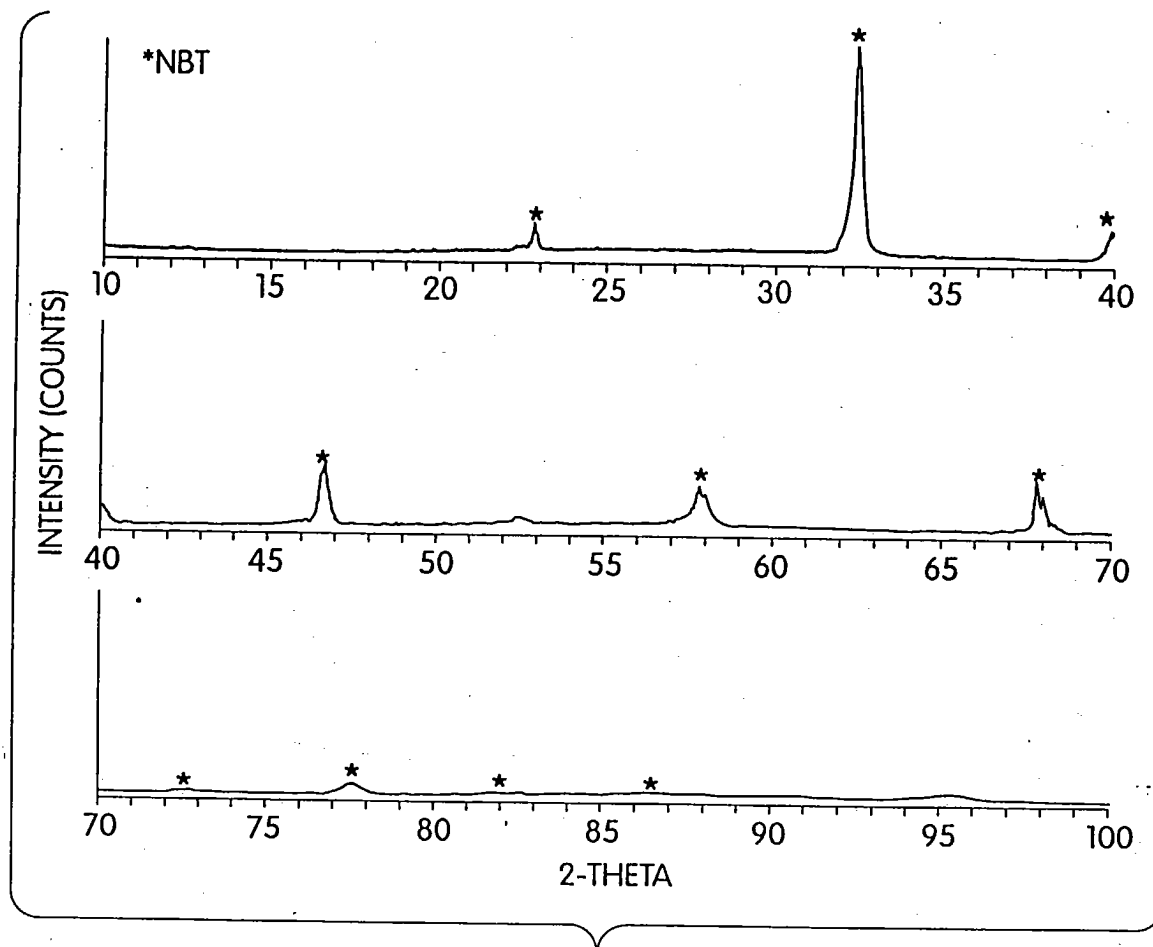


Fig. 28

M00925.70138.US
ELECTROMECHANICAL ACTUATORS
By: Yet-Ming Chiang, et al.
Express Mail Label No.: EV292560361US
Date of Deposit: August 5, 2003

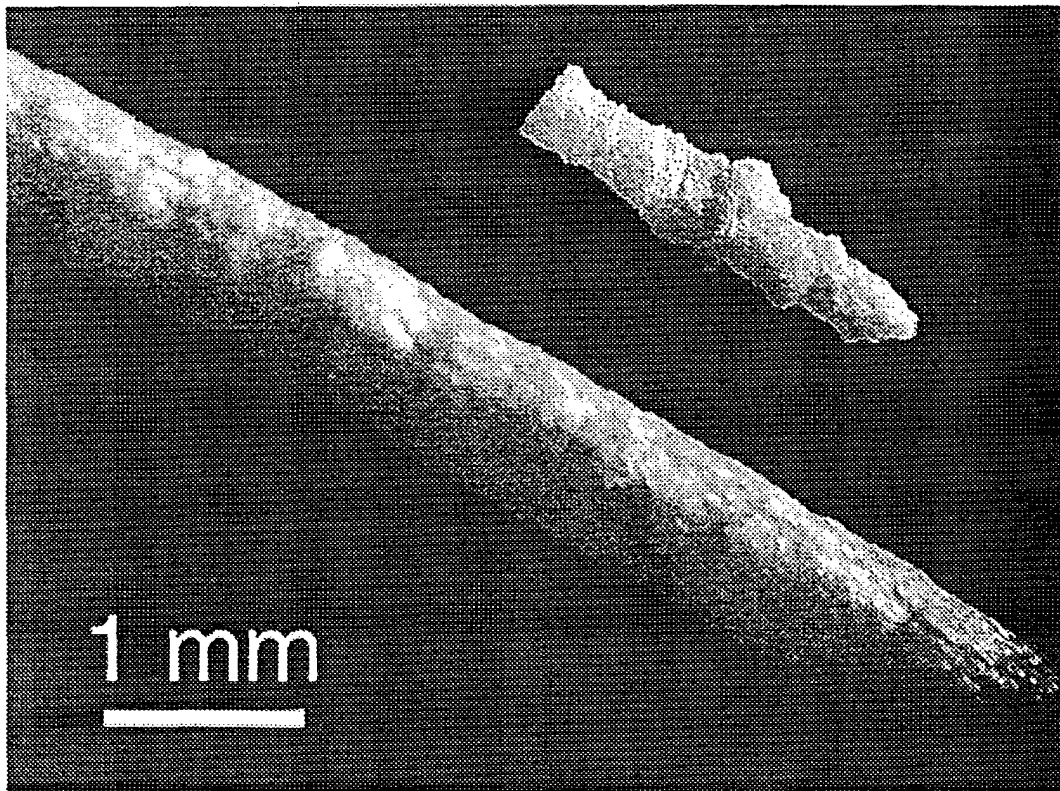


Fig. 29

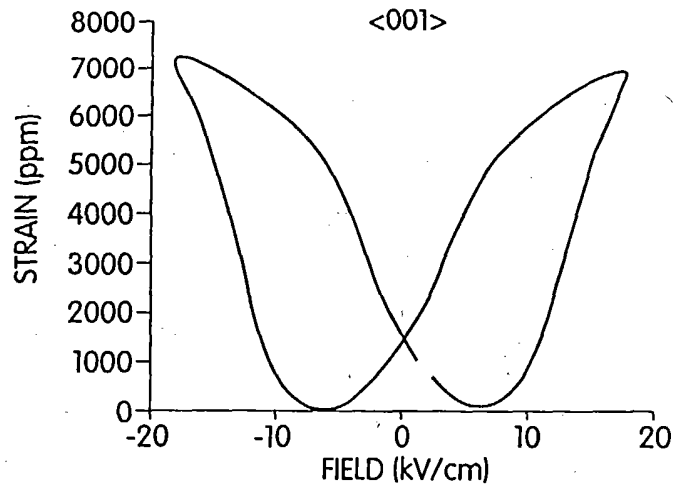


Fig. 30A

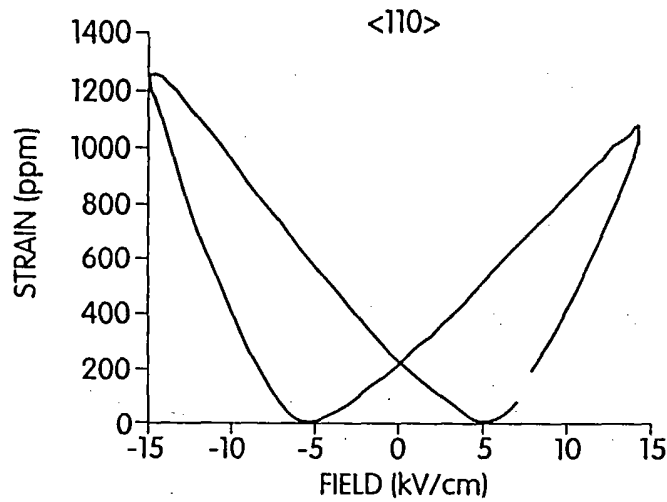


Fig. 30B

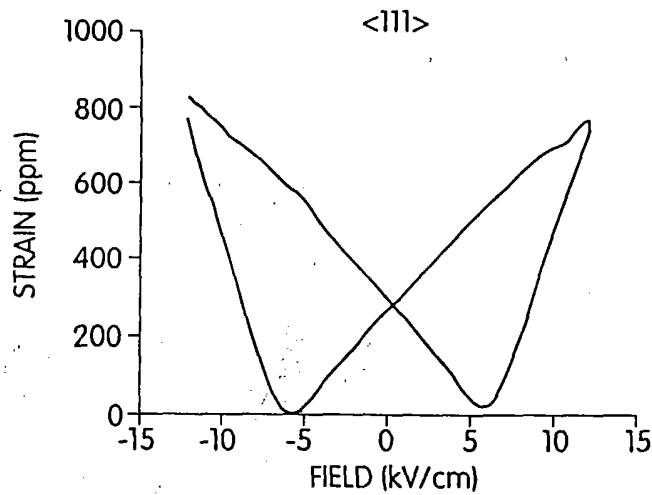


Fig. 30C

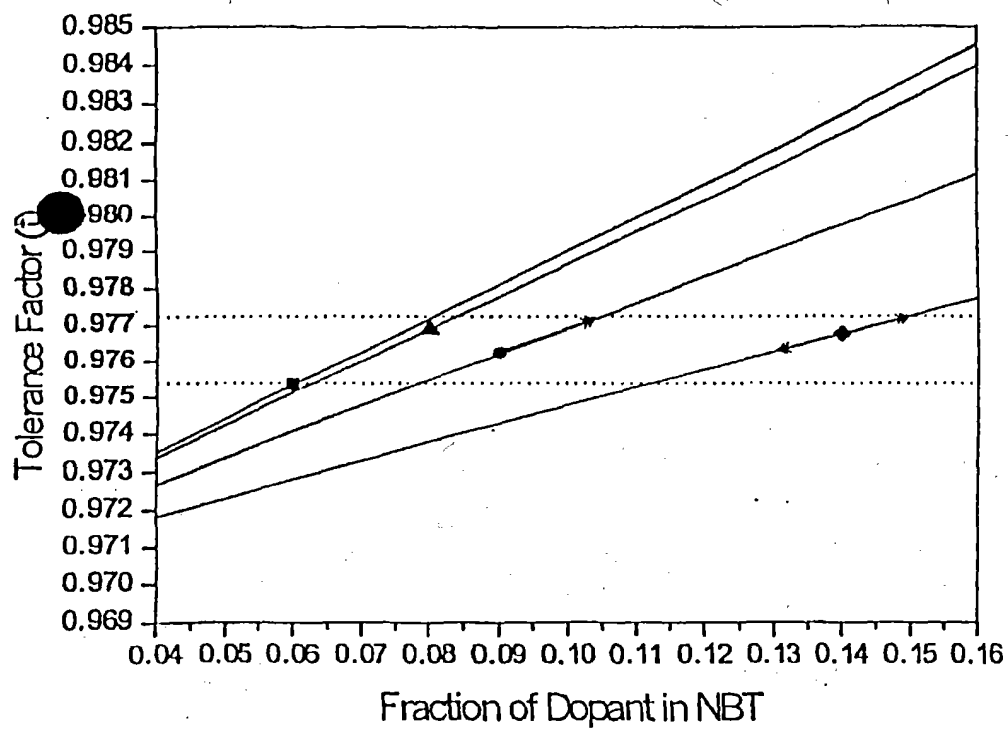


Figure 31

M00925.70138.US

ELECTROMECHANICAL ACTUATORS

By: Yet-Ming Chiang, et al.

Express Mail Label No.: EV292560361US

Date of Deposit: August 5, 2003

Fourier-filtered image

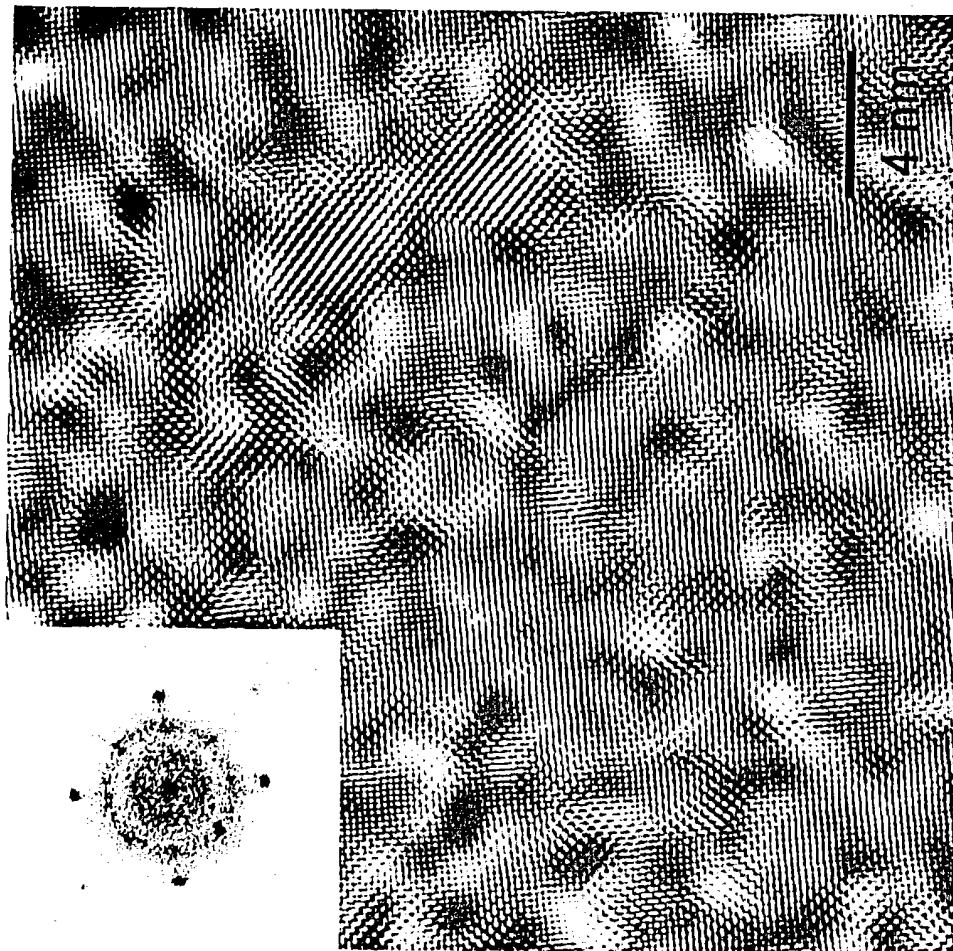


Figure 32

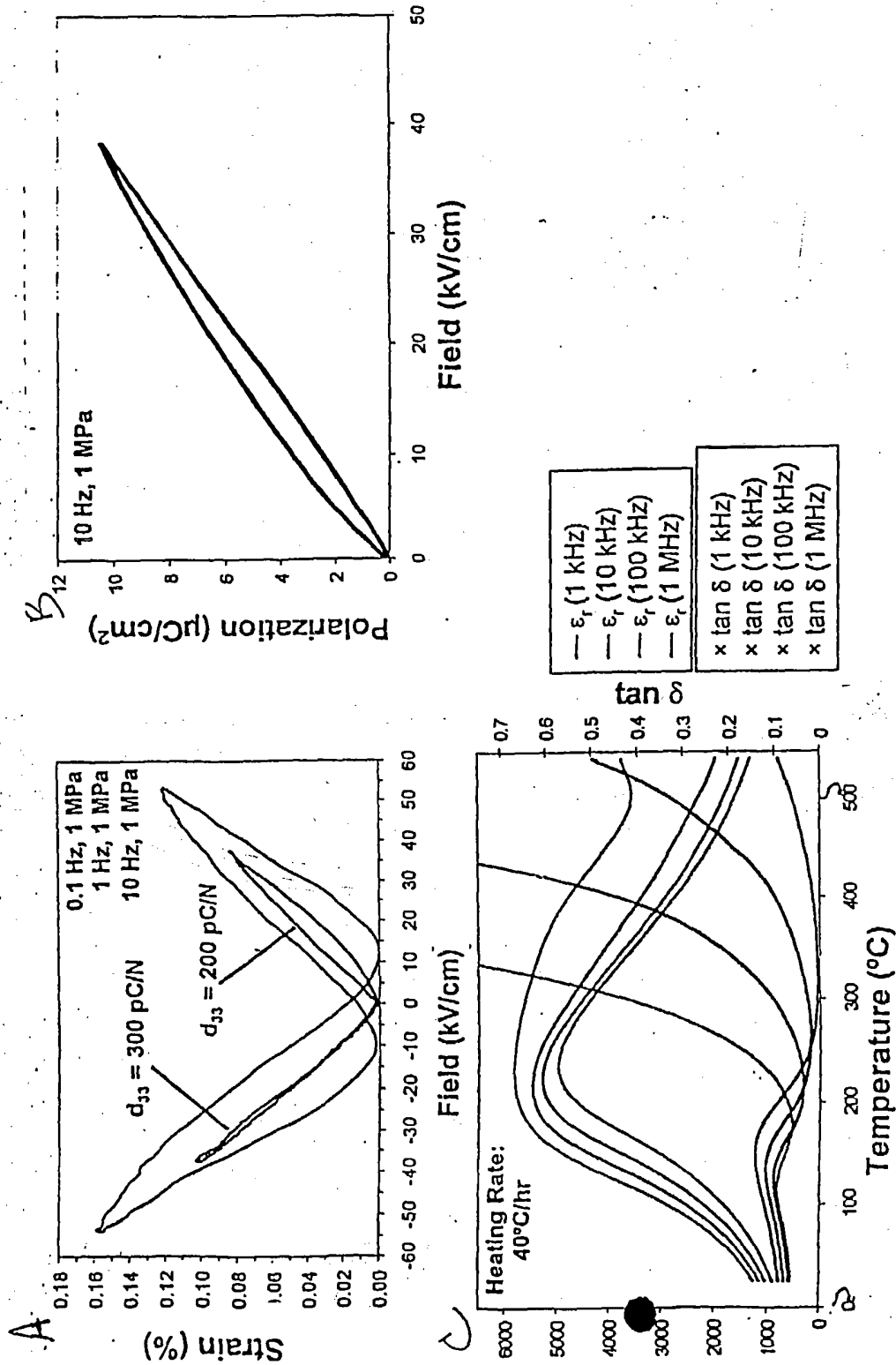


Figure 33

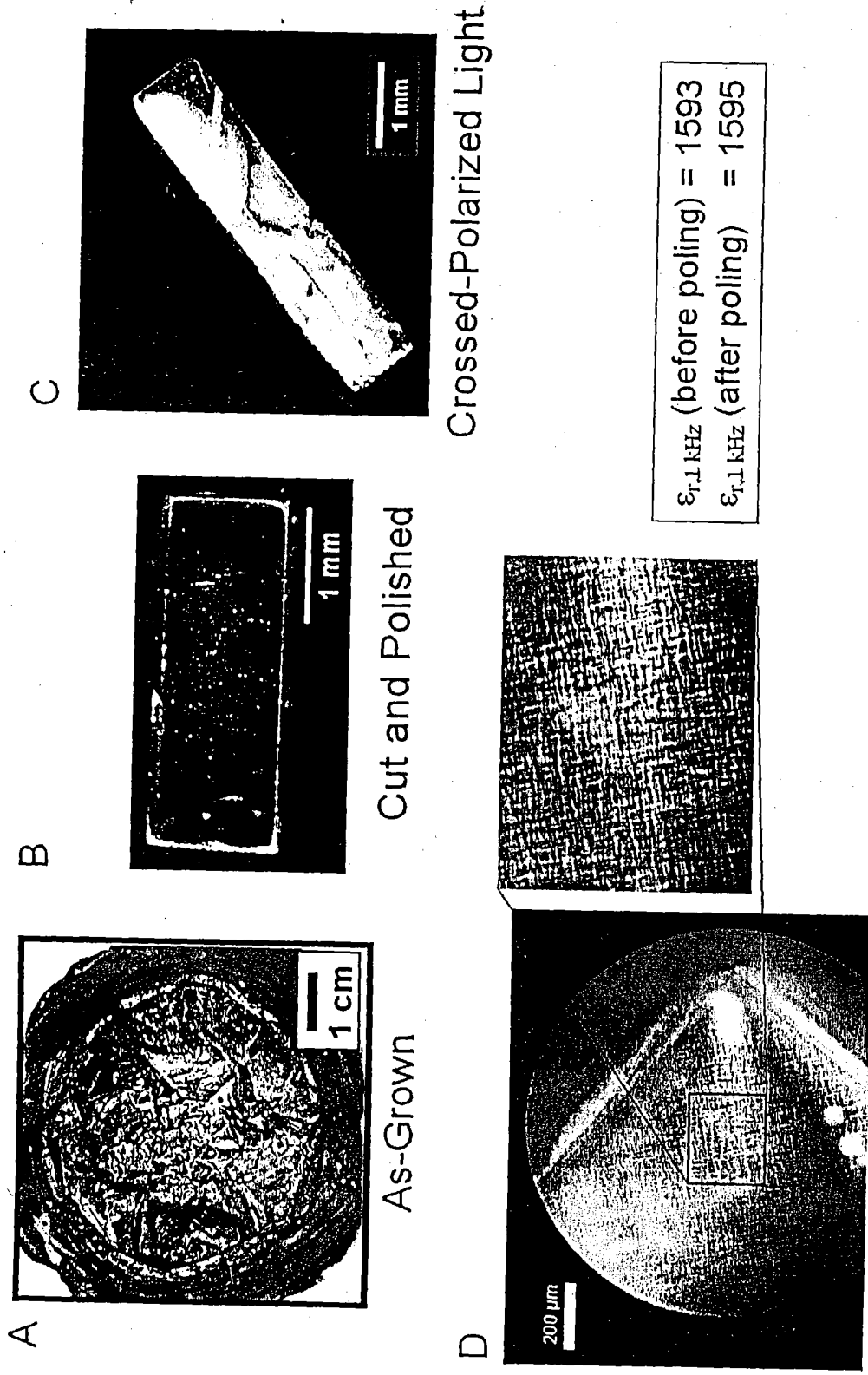


Figure 34

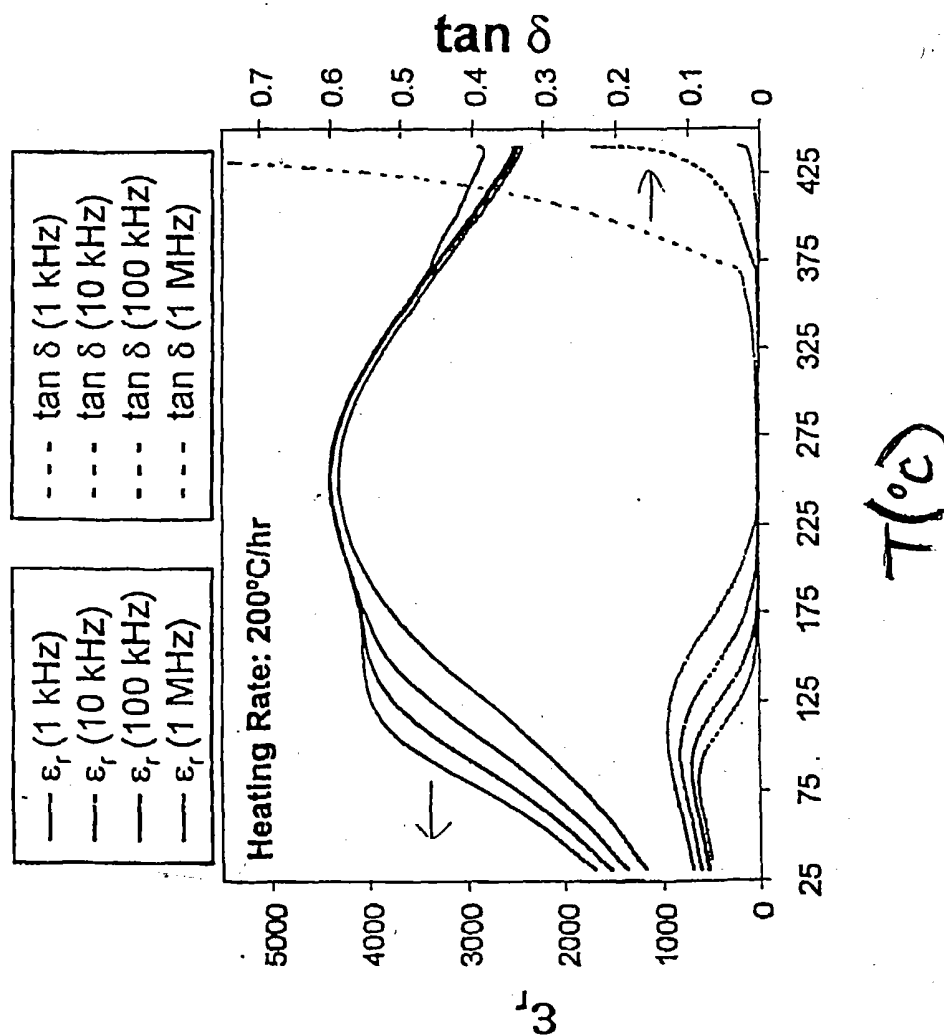


Figure 35

FIG. 36A

- 1 Hz, 8 MPa prestress
- 1 Hz, 8 MPa prestress
- 0.05 Hz, 8 MPa prestress
- 0.05 Hz, 8 MPa prestress
- 5 Hz, 8 MPa prestress

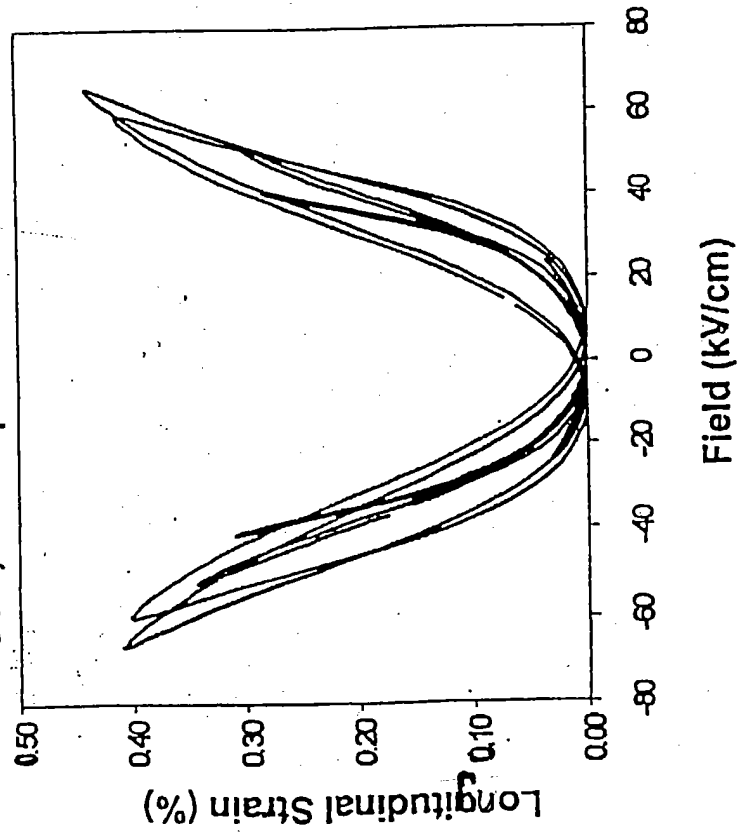
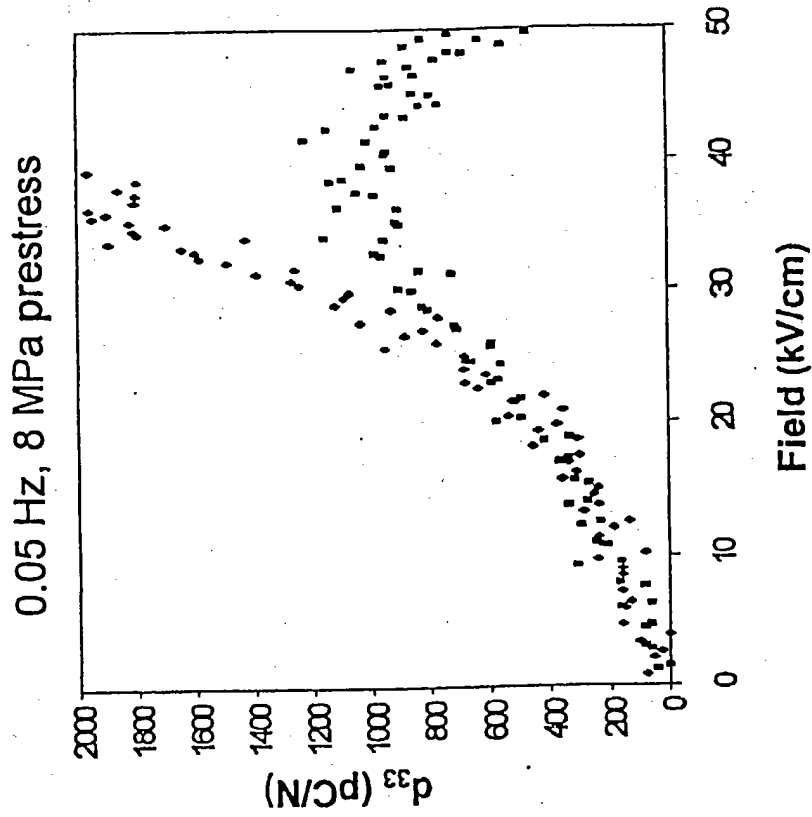


























FIG. 36B



NBT-xBT-3NBZ

mol%Ba	4%	6%	8%	10%	12%	14%
Phase	FER	FFT _R (PE→FE)	PE _T	PE _T	FFT _T (PE→FE)	FE _T
T _m - 0.5 Hz (°C)	119	95	87	90	93	128
Bipolar Field						
Max Bipolar Strain	0.17% at 49 kV/cm	0.28% at 60 kV/cm	0.15% at 49 kV/cm	0.24% at 53 kV/cm	0.26% at 55 kV/cm	0.28% at 49 kV/cm
Unipolar Field						
Max Unipolar Strain	0.08% at 47 kV/cm	0.31% at 73 kV/cm	0.13% at 44 kV/cm	0.21% at 49 kV/cm	0.25% at 53 kV/cm	0.14% at 45 kV/cm
d ₃₃ [pC/N]	170	190 (high field)	—	—	315 (high field)	310
Max d ₃₃ (PE actuation)	—	450 (low field)	500	725	460 (low field)	—
Q ₁₁ [C ² /m ⁴]	—	1.8 (low field)	1.4	1.9	1.8 (low field)	—
Polarization						
P _{max} (C/cm ²)	P _{max} = 37; P _r = 26	36	33	36	41	P _{max} = 49; P _r = 21
Current						

MPB

Figure 37

NBT- x BT-4NBZ Polycrystals at 0.05 Hz, 1 MPa Prestress

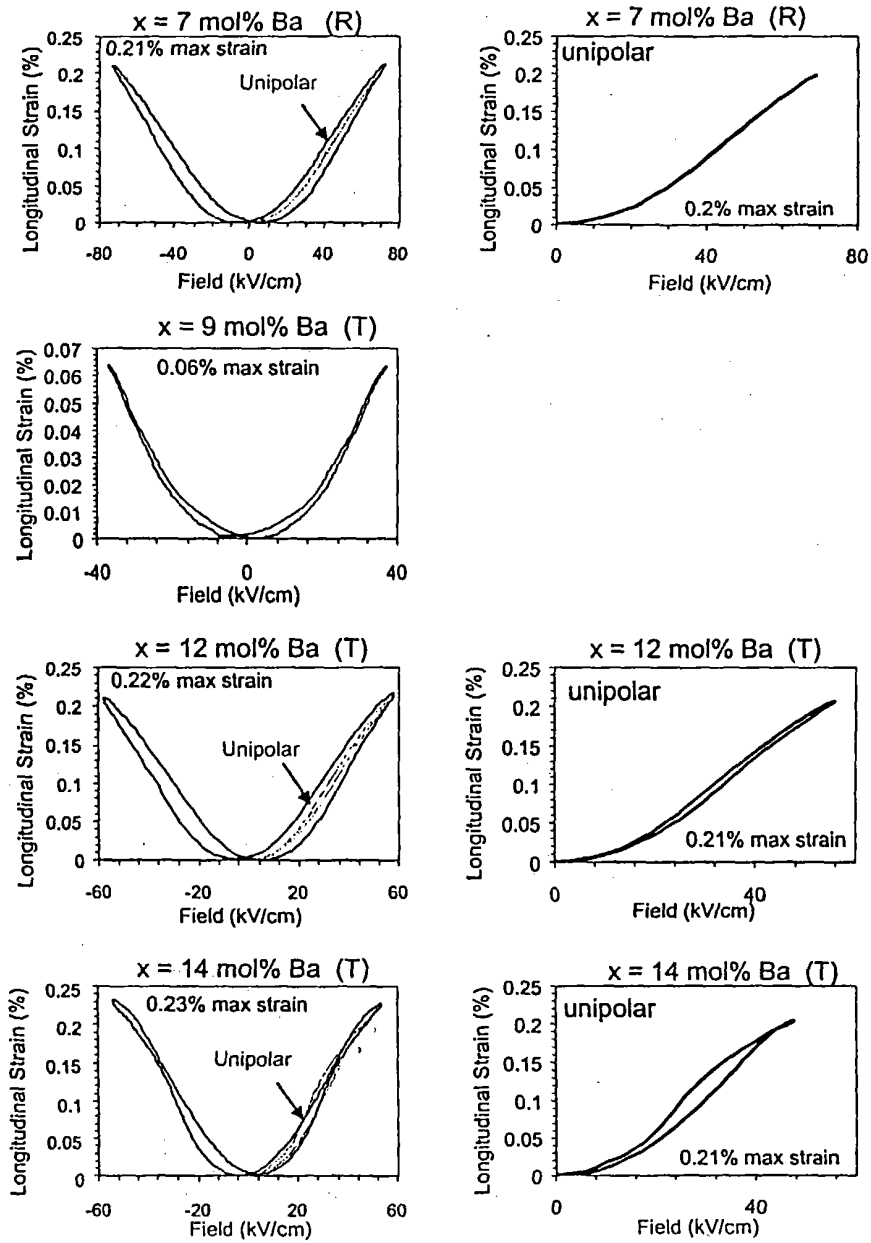


Figure 38

NBT-xBT-4NBZ Polycrystals

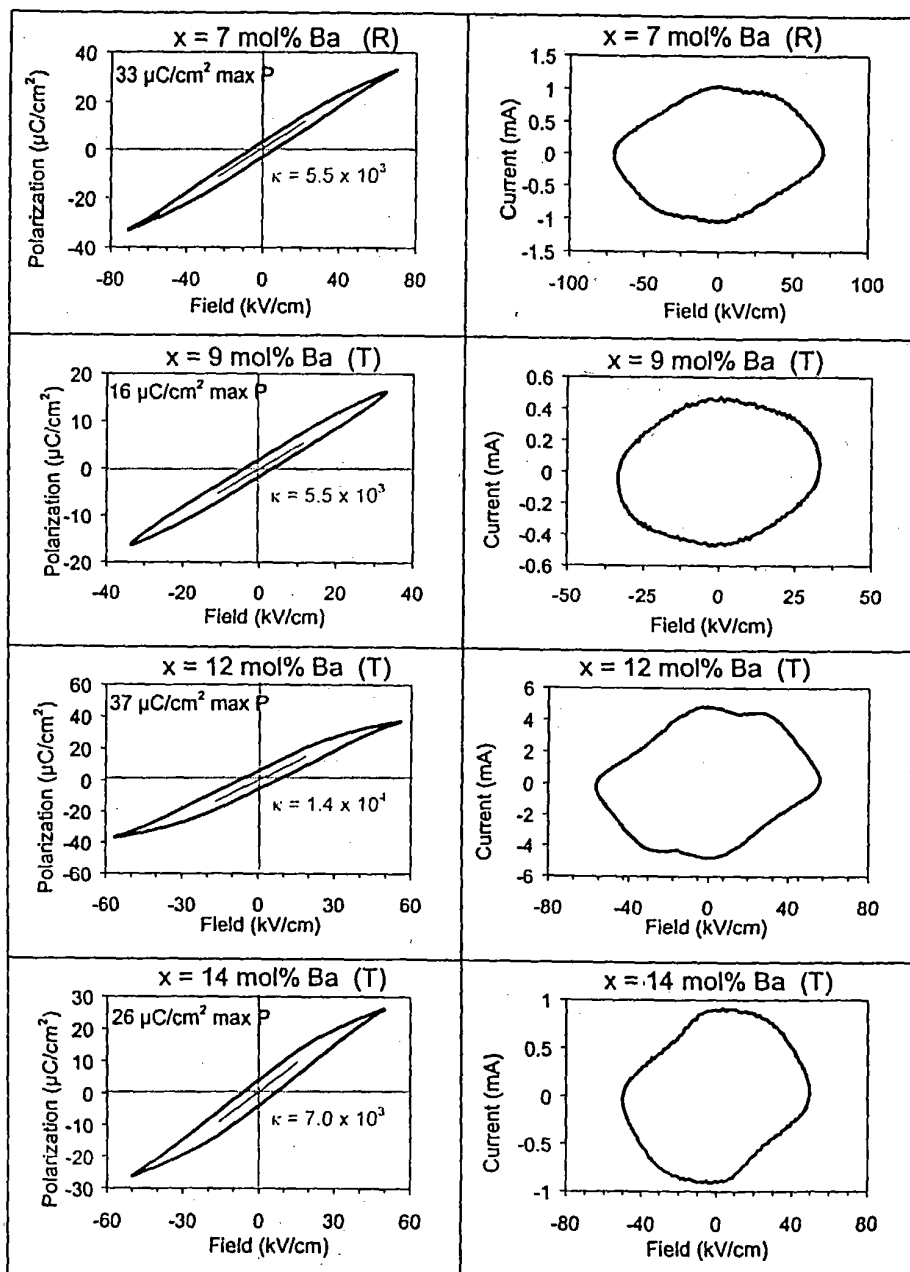
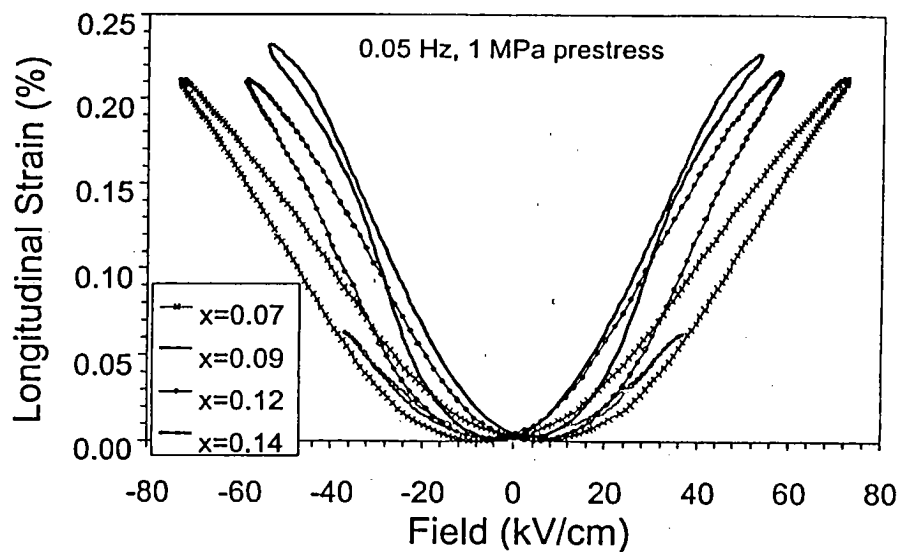


Figure 39

A

NBT- x BT-4NBZ Polycrystals



B

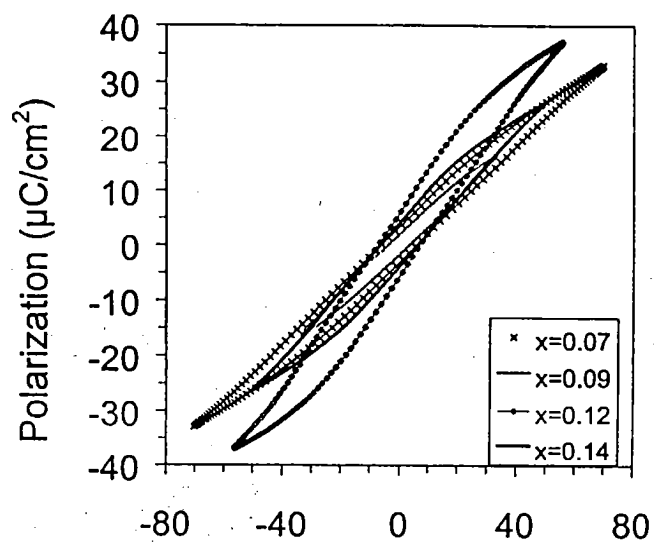


Figure 40

NBT-xBT-4NBZ Polycrystals

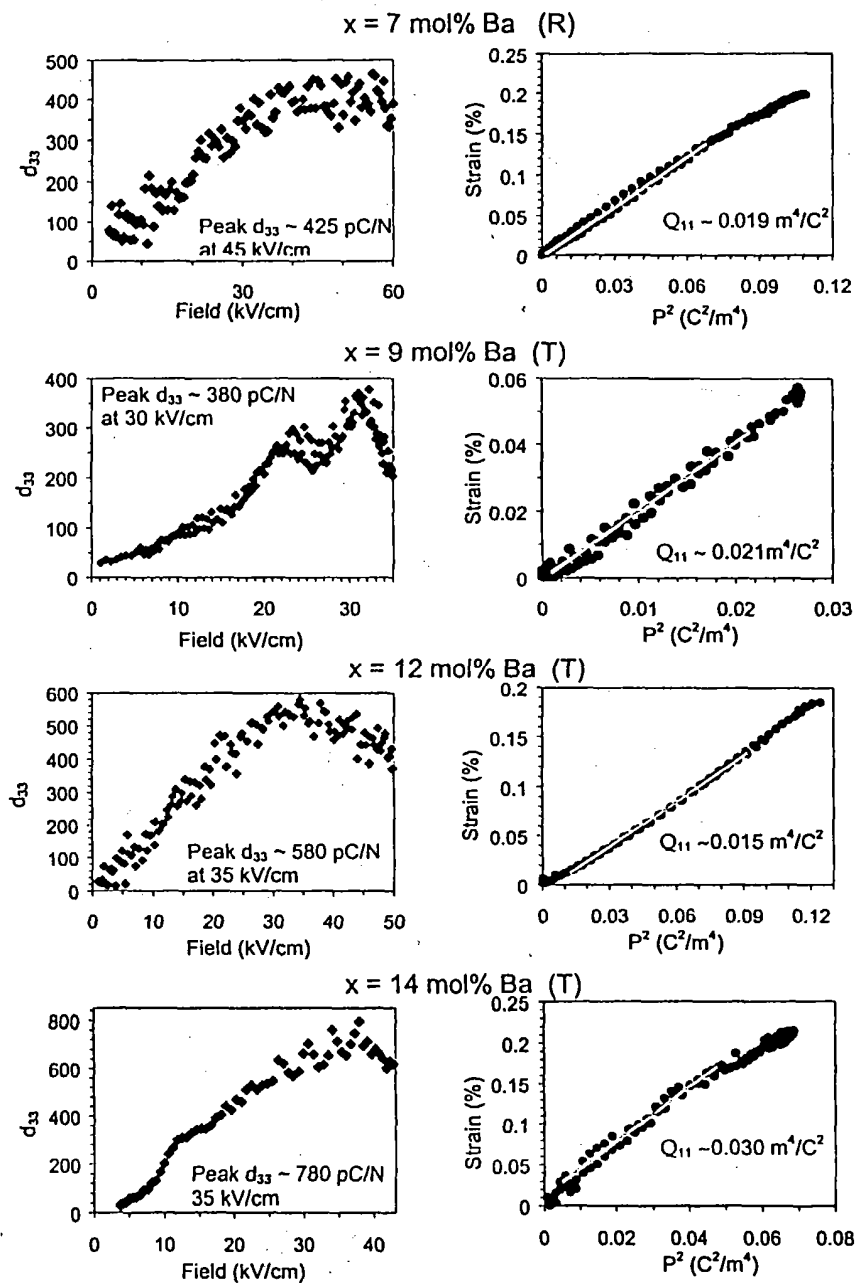


Figure 41

Figure 42

